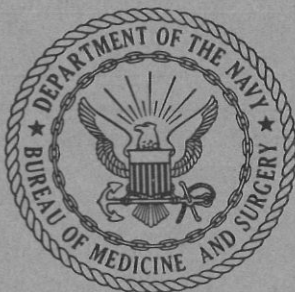


**INTERIM REPORT**  
**ON STUDY OF**  
**ARTERIOSCLEROTIC HEART DISEASE**  
**AMONG**  
**NAVY AND MARINE CORPS MEMBERS**



NAVY DEPARTMENT  
PHYSICAL QUALIFICATIONS AND MEDICAL RECORDS DIVISION  
BUREAU OF MEDICINE AND SURGERY  
JUNE 1965

33B FILES

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INTERIM REPORT ON  
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BUREAU OF MEDICINE AND SURGERY  
Division of Physical Qualifications  
and Medical Records

# ARTERIOSCLEROTIC HEART DISEASE STUDY

## TABLE OF CONTENTS

	Page
Summary of Report	iii
 <u>SECTION I: INTRODUCTION</u>	
Purpose of Study	1
Definition of ASHD Episode	2
Non-ASHD Patients in the Original Sample	3
 <u>SECTION II: METHODS AND SAMPLE DESCRIPTION</u>	
Roster of 1950/51 Heart Patients	4
Investigational Approach	4
Selection of Pertinent Disease Factors for Further Analysis	5
Year of First Episode	6
Size and General Constitution of Sample	7
Age Distribution at Onset and Mortal Status	7
Prior Changes in Service Status and Continuity	9
Officer/Enlisted Composition of Heart Patients	10
Officer Rank Composition of Heart Sample Patients	11
Present Military Retirement Status	12
Other Demographic Descriptions of This Heart Sample	14
 <u>SECTION III: FINDINGS</u>	
A. <u>Factors Regarding Medical History Prior to Onset of ASHD</u>	15
Prior Cardiovascular Patient History	15
Family Cardiovascular and Diabetic History	16
Poor Condition of Teeth	16
Other Minor Ill-Health	17
Prior Hypertensive Blood Pressure and Obesity	17
Prior Venereal Disease History	20
Prior ECG Records	20
Battle Stress, Smoking and Alcohol Consumption	21
B. <u>Complications Following First Episode</u>	22
Cardiac Status at Last Contact	22
Last Recorded Blood Pressure Compared With That of First Episode	24
Other Major Abnormal Conditions Associated With ASHD at Most Recent Contact	26
C. <u>Survival Time for These ASHD Patients</u>	27
First Episode Pattern Type and Survival Time	27
Number of Episodes vs. Elapsed Time Since First Episode	28
Survival Time Versus Age at Onset	30
Survival Time Analysis of Other Factors	30

## List of Charts

	Page
Figure 1: Age at Onset of ASHD in Heart Patients vs. Age of Active Duty Navy	(facing page 8)
Figure 2: Survival Time by Number of Episodes	(facing page 29)
Figure 3: Age at Onset vs. Survival Time (260 Deceased ASHD Patients)	(facing page 30)

## List of Tables in Interim Report

Table: 1: Median Ages of Active Duty Navy in 1950/51 Compared With Those of Confirmed ASHD Patients	7
Table 2: Age at Onset of ASHD for 501 Confirmed ASHD Patients (By 5 Year Age Groups)	8
Table 3: Military Service of ASHD Patients Prior to Onset of ASHD	10
Table 4: Marine Corps and Active Duty Navy Heart Patients	11
Table 5: Officer Rank Frequencies in Heart Sample Compared With Active Duty Navy	12
Table 6: Present or Most Recent Military Retirement Status of 504 Patients	13
Table 7: Prior History of Hypertensive Blood Pressure Levels and Obesity	19
Table 8: Cardiac Status at First Episode Compared With Status at Last Contact	24
Table 9: Blood Pressure at First Episode Compared With Last Recording	27
Table 10: Survival Time By Severity of First Episode Type	31
Table 11: Patients Having One or More ASHD Episodes, By Survival-Time Group	32

## List of Appendices to Interim Report on ASHD Study

Appendix A: Part 1: Arteriosclerotic Heart Disease Defined	A1
Part 2: Schedule of ASHD Pattern Types	A4
Part 3: Criteria for Acceptance of ASHD Pattern Types	A5
Appendix B: Part 1: List of Supplemental Statistical Tables	B1
Part 2: Supplemental Statistical Tables	B1
Appendix C: Statistical Development of Heart Sample	(Bound separately)
Appendix D: Non-ASHD Patients in the Heart Sample	(Bound separately)
Appendix E: Analysis of Sudden-Death Cases	(Bound separately)



### SUMMARY OF REPORT

This report briefs two years of statistical research on a sample of 555 Navy and Marine Corps members first diagnosed for coronary or arteriosclerotic heart disease (ASHD) in 1950 or 1951. Three confirmed cases have been excluded from the analysis because the date of onset and number of episodes were obscure; fifty-one (51) more have been separated from this presentation because the original ASHD diagnosis could not be confirmed.

Available data on the physical and medical characteristics of the remaining 501 confirmed cases were analyzed in an effort to reveal significant differences between the still-living segment (241 cases) and the now-dead portion (260). Where substantial differences appeared in these two groups in the relative proportions showing a given characteristic or in the total proportion showing such a characteristic, this quality was pinpointed for later, survival-time analysis and for comparison with available data on 600 controls.

The present report summarizes what we know about the cases generally, earmarks those characteristics appearing significant and demonstrates the survival-time procedure to be used later in analysis of those characteristics. The selected characteristics are: age at onset, continuity of military service, rank/rate composition, rank of officers, patient cardiovascular (CV) history, family CV history, prior ill-health, and prior hypertensive blood pressure and/or obesity. History of battle stress and of excessive smoking and alcohol consumption also were considered, but the meagreness and questionable reliability of data available, particularly on the latter two items, discouraged analysis.

An initial working premise of the study has been verified, i.e., that the severity of the first ASHD episode appears to color and limit the future of an ASHD patient and relates inversely to his survival after ASHD onset. Likewise the number of episodes relates directly to severity of the first episode and indirectly to survival time.

## SECTION I

### INTRODUCTION

in the Naval Service, as in the general population, arterio-sclerotic heart disease (ASHD) or coronary heart disease (CHD)<sup>1/</sup> contributes heavily to the record of ill-health tallied in the non-effective rates, invalidings, causes of death and other morbidity and mortality indices. This statistical investigation explores coronary heart disease occurrence in Navy and Marine Corps members in order to identify the most frequently encountered patterns of the disease and, for each such pattern, to estimate prognosis and determine time intervals of disease progression -- correlating these to administrative waiting periods used in medical disposition of affected members. This tests validity of our post-coronary restrictions on such members and furnishes generally applicable information on prognosis. Further, other reliable, possibly significant items in each victim's naval medical record have been explored in a search for clues as to this enigmatic condition's epidemiology.

These records cover an extended period pre- and post-attack and include complete information on all medical events in the individual's military career such as induction, subsequent annual and other periodic physical examinations, and clinical summaries of Navy hospital treatment for all illnesses. All told, five

<sup>1/</sup> See Appendix A (Part 1) for definition of ASHD.

hundred fifty-five (555) records were analyzed. This included all records of servicemen diagnosed as having ASHD in 1950-51, a period selected to assure a desirable minimum sample size and more than ten years follow-up. Of the 555 then so diagnosed, the study team, in retrospect, considered the diagnoses incorrect in fifty-one (51) cases. In three (3) additional cases date of onset could not be determined. This narrowed to five hundred one (501) the number of records of confirmed ASHD cases subject to more detailed analysis.

#### Definition of ASHD Episode

An "episode" is defined for the purpose of this study as an attack of a well-recognized manifestation of arteriosclerotic or coronary heart disease, requiring, in the opinion of the attending doctors, more than a few days of hospital care -- usually several weeks or more. The manifestations were usually initiated by acute symptoms -- regardless of the real severity of the actual episode. These manifestations included angina pectoris without proven myocardial damage; acute myocardial infarction, both with and without other complications; and a variety of borderline and atypical forms occurring much less frequently. These patterns are defined in Appendix A (Parts 2 & 3), together with the acceptance criteria, used by the study team and by the medical review panel cooperating in this study, in earmarking episodes as those of ASHD.

The beginning date of the first episode (for this study) is defined as representing the practical "onset" of this disease. This date is recognized as an arbitrary base line -- chosen in order to be able to compute time-intervals related to the progression of the disease and to the related administrative steps taken. This definition was agreed to as a practical measure, in spite of the theoretical difficulty of establishing real date of onset <sup>2/</sup>.

#### Non-ASHD Patients Excluded From the Original Sample

Among the 555 original patients in this "heart" sample, there were 51 whose complete medical records and subsequent history were insufficient evidence in the opinion of our medical staff review panel, to justify the original ASHD diagnosis. These 51 patients are excluded from nearly all subsequent statistical analyses but are discussed separately in Appendix D.

<sup>2/</sup> For the few patients whom we think had ASHD "onset" prior to first episode date, an analysis will be presented in a later report -- indicating approximately the small effect upon data reported herein.

## SECTION II

METHODS AND SAMPLE DESCRIPTIONRoster of 1950/1951 Heart Patients

As previously mentioned, to obtain at least 10 years follow-up and to obtain what was considered to be a minimum in desirable sample size, all names of service members who had admissions for ASHD in 1950 or 1951 were obtained from a statistical file of cards maintained by this Bureau. The procedure for drawing these names is described in Appendix C, together with a detailed statistical protocols for the resulting sample. A brief resume of this sample character follows in this section.

Investigational Approach

For the purposes of this study, the assumption was made: (1) that the severity of the first episode bears some inverse relationship, mathematically, to the survival time; (2) that this severity was further much affected by the number and character of subsequent episodes and their complications; and (3) that age of the patient was also an important determining factor. With these assumptions in mind, data were collected regarding the details of the first episode -- as well as for prior medical history, physical examination measurements throughout the patient's naval career, and details regarding subsequent episodes. Crucial dates involved in these medical events were also transcribed as well as corresponding administrative actions and their dates, relating to development of ASHD.

The resulting transcribed and numerically coded data, transferred to punch cards, were supplied to the National Naval Medical Center's Data Processing group for processing. This group produced routine numerical and percentage distributions, as well as corresponding time-interval computations used as the basis for the following analyses. These machine computations were made for all data items which had previously appeared to be significant on the basis of a smaller, hand-tabulated random sample examined in 1963. A further step of completed statistical analysis covered the relationship of survival-time to severity of first episode and to number of episodes.

#### Selection of Pertinent Disease Factors for Further Analysis

In the selection of NNMC machine processed data for further statistical analyses presented in this report, the following premises <sup>3/</sup> were used as possible indications of contribution to ASHD:

(a) when there was a significantly larger fraction of deceased patients in our sample showing a selected characteristic than among living ones; (b) when, irrespective of the living/dead ratio, a substantial fraction of the whole sample of patients showed

<sup>3/</sup> In addition to the three assumptions (1, 2 and 3) discussed on the previous page.



this characteristic <sup>4/</sup>; or (c) when the characteristic had been reported by many other investigators as being significantly related to development of ASHD. With regard to condition c, we were unable for some factors to evaluate statistically such data on these patients, because of a paucity or complete lack of appropriate data <sup>5/</sup>.

The resulting analyses are, therefore, based principally on conditions a and b. It was felt that when either or both of the latter occurred, the results would be highly suggestive of a real relationship to incidence, severity and progression of ASHD. In following reports we shall examine each of these selected factors -- earmarked in this fashion -- in relation to survival-time and to other measures of severity and development of this disease process.

#### Year of First Episode

Most patients in the original 555 sample had hospitalizations for ASHD in 1950 or 1951; however, a medical record review suggests that perhaps 15 percent had real but then unrecognized first episodes in earlier years -- most of these in 1949. Intensive study of these histories is needed to determine the approximate date of the real onset of ASHD. Such patients can be then assigned to morbidity computations for those earlier years.

<sup>4/</sup> Generally at least a quarter or more of the whole group of 501 patients and usually a third of them or more.

<sup>5/</sup> Such as for SGOT and serum cholesterol lab test results, smoking habits, alcohol consumption, diet, emotional stress, etc.

### Size and General Constitution of Sample

The 501 confirmed ASHD patients included 210 officers and 291 enlisted men. Officers constituted 42 percent of the total -- in contrast to the 10-12 percent annual average in the active duty Navy since 1950. This high proportion of officers in the heart sample is largely due to the fact that ASHD primarily attacks men in middle and older ages, whereas the Navy enlisted strength is primarily in a much lower age range. Moreover, the fact that officers are given much more frequent examinations may account for some of this difference. The opportunity to observe cardiovascular abnormalities among officers is, therefore, larger.

The table below compares the age range and median age <sup>6/</sup> for the whole Navy strength in 1950/51 with corresponding ages at onset for the ASHD group.

TABLE 1: AGE RANGE AND MEDIAN AGES: ACTIVE DUTY NAVY (1950/51) VS. ASHD PATIENTS AT ONSET

Age Statistic	Officers		Enlisted Men	
	Active Navy	ASHD Patients	Active Navy	ASHD Patients
Age Range	19-65	23-65	17-64	21-62
Median Age <sup>a/</sup>	32.7	46.7	23.7	40.5

<sup>a/</sup> Estimated values based on 5 year age groups; it is known, however, that there were a significant number of older officers from whom at least two of the 65 year old officer ASHD patients were drawn.

### Age Distribution at Onset and Mortal Status

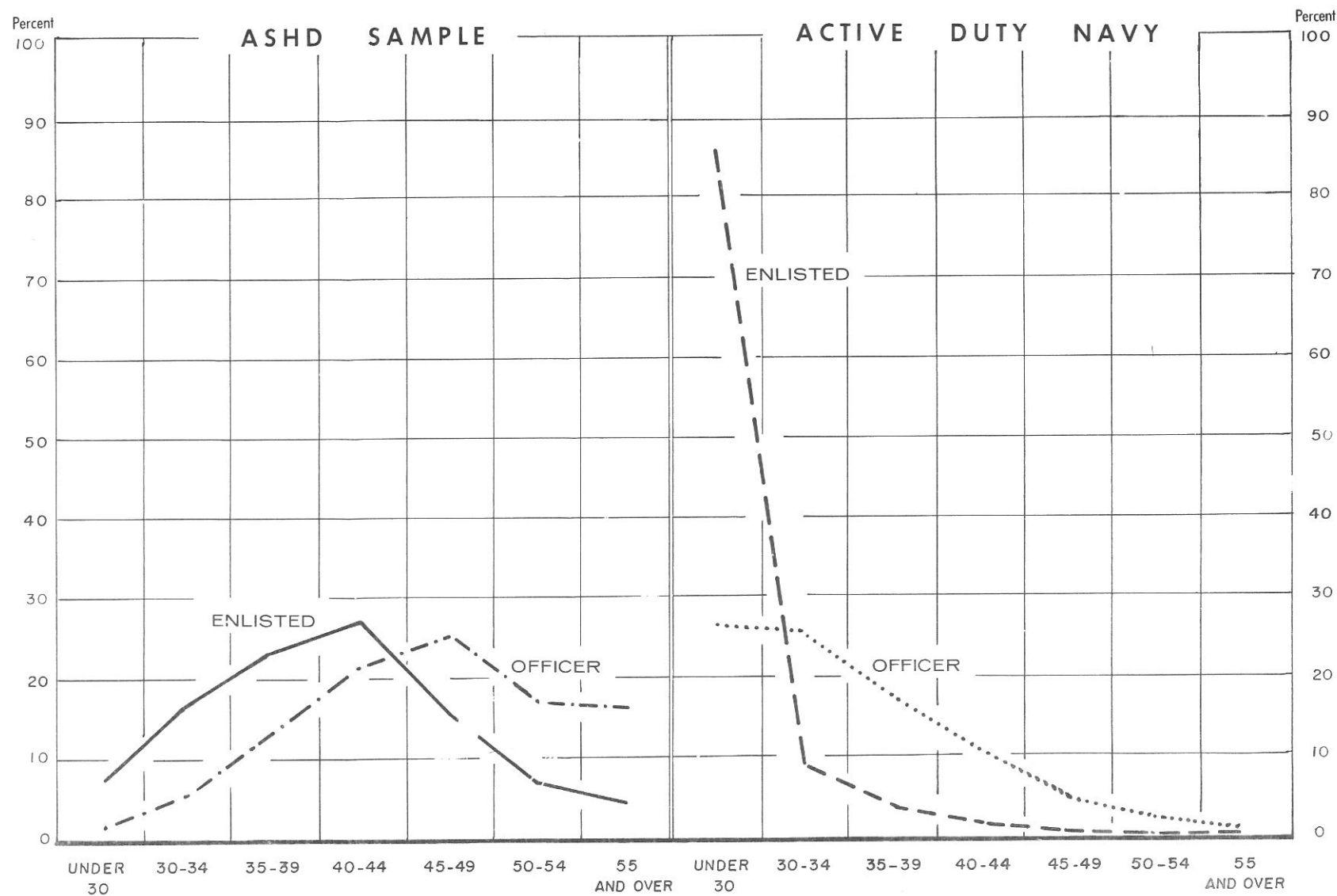
Table 2 on the next page shows the age distribution for living and dead ASHD patients in this sample, for officers separately

<sup>6/</sup> Median age is the age of the "middle" man in an aged-ordered rank -- a measure not subject (as is the arithmetic average) to the effect of extreme values on either end of the time scale.

Figure 1

# AGE AT ONSET OF ASHD IN HEART PATIENTS vs AGE OF ACTIVE DUTY NAVY

(Curves represent proportions of each group by five-year intervals)



from enlisted men. From this table it is evident that a larger proportion of enlistees in this group have died (54 percent) in the last twelve years than have officers (49 percent). Moreover, it is clear that the enlisted men generally acquired this disease at considerably younger ages than did the officers. Reference to Table B in Appendix B (in contrast to Table 2 below) for the whole active duty Navy in 1950/51 shows the differences in age distributions of ASHD patients, compared with the population at risk from which these patients were drawn. (See Figure 1 on the facing page).

TABLE 2 : AGE AT ONSET FOR 501 CONFIRMED ASHD PATIENTS  
(By 5 Year Age Groups)

Age Group in Years	Living				Dead			
	Officer		Enlisted		Officer		Enlisted	
	Number	Per- Cent	Number	Per- Cent	Number	Per- Cent	Number	Per- Cent
Total	<u>108</u>	<u>100.0</u>	<u>133</u>	<u>100.0</u>	<u>102</u>	<u>100.0</u>	<u>158</u>	<u>100.0</u>
Under 30	2	1.8	10	7.5	-	-	13	8.2
30-34	6	5.6	14	10.5	6	5.9	34	21.5
35-39	16	14.8	31	23.3	11	10.7	36	22.8
40-44	23	21.3	45	33.9	22	21.6	34	21.5
45-49	26	24.1	19	14.3	28	27.5	24	15.2
50-54	18	16.7	10	7.5	18	17.6	9	5.7
55 and over	17	15.7	4	3.0	17	16.7	8	5.1
Estimated Median age in years	46.4		41.3		47.1		39.5	

### Prior Changes in Military Status and Service Continuity

The great bulk of these ASHD patients had experienced no recent major change from enlisted to officer rank or the reverse prior to onset of ASHD. A fifth of them experienced acquisition of officer rank some time before their first episodes. A very small group (5 percent) reverted from a previously held officer status, acquired during World War II, to enlisted status in order to stay on active duty during the period 1946-1949.

If we examine the continuity of duty, however, some notable differences are apparent. There are three basic patterns of service shown by these patients: (a) continuous duty through World War II, through the intervening years and into the Korean activity period before experiencing a first episode of ASHD; (b) continuous duty but with a first episode before the Navy became involved in the Korean-Pacific activity <sup>7/</sup>; and (c) released to civilian life following World War II, but recalled to active duty in 1950/51 for the Korean buildup. Table 3 on following page shows the numbers and proportions of such patients in each of these three categories.

<sup>7/</sup> That is, such a patient may have had a first episode before June 1950, or possibly after that date but was stationed at a place where he was unlikely to be directly involved with Pacific activities (Atlantic Coast, the Caribbean, etc.).

Table 3: MILITARY SERVICE OF ASHD PATIENTS PRIOR TO ONSET OF ASHD

Type of Prior Service	In Number of Patients			In Percent of Totals		
	Total	Living	Dead	Total	Living	Dead
(1) OFFICER PATIENTS:	<u>227</u>	<u>118</u>	<u>109</u>	<u>100</u>	<u>100</u>	<u>100</u>
Continuous duty, both war periods	119	66	53	53	56	49
Continuous duty but excl. Korean period	86	41	45	38	35	41
Recalled for Korean period	19	10	9	8	8	8
Other pattern	3	1	2	1	1	2
(2) ENLISTED PATIENTS:	<u>325</u>	<u>149</u>	<u>176</u>	<u>100</u>	<u>100</u>	<u>100</u>
Cont. duty, both periods	150	65	85	46	44	48
Cont. duty excl. Korean period	58	22	36	18	15	20
Recalled for Korean period	112	60	52	34	40	30
Other pattern	5	2	3	2	1	2

This table shows a much higher proportion (34 percent) of recalled enlisted patients than officers (8 percent), as would be expected from the changes in Navy strength patterns following World War II, as between officers and enlisted personnel. The question arises, however, whether stresses possibly produced by recall could have any significant effect on onset of ASHD. We cannot answer this question now.

#### Officer/Enlisted Composition of Heart Sample Patients

Table 4 on the next page shows the composition of the whole heart sample of 555 patients, divided between officers and enlisted men, and between Marine Corps <sup>8/</sup> and active duty Navy.

<sup>8/</sup> Marine Corps members are included both in the heart patient group and in the total Navy figures because their medical care is provided by the Navy Medical Department.



Table 4: ACTIVE DUTY NAVY AND MARINE CORPS HEART PATIENTS (1950/51)  
VS. WHOLE ACTIVE DUTY NAVY/MARCORPS

Rank - Rate Group	Total		Navy		MarCorps	
	Number	Percent	Number	Percent	Number	Percent
All Heart Patients	<u>555</u>	<u>100</u>	<u>503</u>	<u>100</u>	<u>52</u>	<u>100</u>
Officers	230	41	214	42	16	31
Enlisted men	325 <sup>a/</sup>	59	289	58	36 <sup>a/</sup>	69
-----						
Heart Patients:	(Percents computed as fractions of each line total)					
Total Officers	230	<u>100</u>	(214)	93	(16)	7
Total Enlisted Men	325	<u>100</u>	(289)	89	(36)	11

Active Duty Navy and Marine Corps Strength (1950 plus 1951)  
(In thousands of members, as of 31 January)

Totals:	<u>1,309.9</u>	<u>100</u>	<u>1,015.0</u>	<u>100</u>	<u>293.9</u>	<u>100</u>
Officers	137.8	11	114.9	11	22.9	8
Enlisted Men	1,172.1	89	901.1	89	271.0	92
-----						
	(Percents computed as fractions of each line total)					
Total Officers	137.8	<u>100</u>	(114.9)	83	(22.9)	17
Total Enlisted Men	1,172.1	<u>100</u>	(901.1)	77	(271.0)	23

a/ Includes 10 Marine Corps enlisted men, later adjudged to be non-ASHD patients. No Marine Corps officers were so labeled.

#### Officer Rank Composition of Heart Sample Patients

Table 5 on the next page compares the distribution by rank of officers in the original heart sample with that for all officers on active duty in the Navy and Marine Corps in 1951. Among the heart patients, there were 45 percent of officers who were Admirals, Captains, Commanders and equivalent Marine Corps ranks, in contrast to only 12 percent of the corresponding ranks in the whole active duty Navy and Marine Corps in 1951. This much higher preponderance of senior ranks among the heart sample is no doubt largely the result of their higher ages, coupled with the age-selective attack rate of ASHD, as discussed previously in this report on page 7.

TABLE 5 : OFFICER RANK FREQUENCIES IN THE HEART SAMPLE COMPARED WITH ACTIVE DUTY NAVY (1950/51)

Rank	<u>Heart Sample</u>		<u>Active Duty Navy and Marine Corps</u>	
	(Active Duty Navy and Marines: 1950/51 Admissions)		(30 June 1951)	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
All Officers (Incl. Marine Corps) Total	<u>230</u>	<u>100</u>	<u>85,663</u>	<u>100</u>
Admirals-				
Generals	24	10	326	(*)
Captains-				
Colonels	47	21	3,222	4
Commanders-				
Lt. Colonels	33	14	6,628	8
Lt. Commanders-				
Majors	42	18	10,478	12
Navy Lts., Ltjgs. Ensns; and MarCor				
Captains and 1st and 2nd Lts.	50	22	58,904	69
Warrant Officers	34	15	6,105	7

(\*) Less than 0.5 percent

Present Military Retirement Status (or status at last contact or death)

Table 6 on the next page shows the mortal and retirement status of 504 confirmed ASHD patients, with a percentage distribution for the living as distinct from those now dead. Over three-quarters of the living have acquired a permanent disability retirement -- most of them within five years following onset. Another 10 percent were discharged, usually with severance pay, but without retirement status, usually within a year following onset of the disease. The remaining 12 percent fell into other miscellaneous categories -- only 3 patients, or 1 percent, being returned to active duty after

having acquired an ASHD diagnosis in 1950 or 1951.

Among patients now dead, 43 percent died in an active duty status, usually suddenly or before any change in duty status could be effected. Another 39 percent were permanently retired before death occurred; 9 percent died in a temporary disability retirement status, before they were permanently retired. A small fraction (4 percent) died of accident or of other diseases, some also while temporarily or permanently retired.

Table 6: PRESENT OR MOST RECENT MILITARY RETIREMENT STATUS OF 504 PATIENTS <sup>a/</sup>

Military status at last contact	Total	Still Alive		At time of death	
		Number	Percent	Number	Percent
All ASHD patients	<u>504</u>	<u>241</u>	<u>100</u>	<u>263</u>	<u>100</u>
Permanently retired for ASHD	292	189	79	103	39
Active duty status, last contact	116	3	1	113	43
Discharged without retirement	29	24	10	5	2
Temporary Disability retirement	28	5	2	23	9
Other retirement status	28	20	8	8	3
Non-ASHD deaths	11	--	-	11	4

<sup>a/</sup> Includes 3 officers with unknown onset dates but whose final retirement and mortal status was known, who have been omitted from some subsequent tables involving date of onset or other missing dates.

### Other Demographic Descriptions of This Heart Sample

Only minor differences appear between a regional geographic distribution of "place of birth" of these patients and a regular Navy enlisted roster tallied in late 1963. Although some definitional differences exist between these two sets of data <sup>9/</sup>, there appears to be no large apparent bias, geographically, in the distribution of these patients compared with that of the whole Navy. A similar correspondence also is apparent in relation to the distribution of the whole U. S. population <sup>10/</sup> (Table C: Appendix B).

Five-sixths of the heart sample patients were married prior to onset of ASHD, the remaining 15 percent being almost equally divided among divorced or separated persons, single persons, or persons with second marriages.

Differences in religious diet-custom involved only a minute fraction of this sample, since only one percent were of Jewish or other religion which observes distinctive diets. The remainder were either Protestant or Catholic, with nearly similar religious diet-restriction.

<sup>9/</sup> "Place of birth" is available for the 1950/51 heart patients; only "place of first enlistment" for the whole enlisted Navy in 1963. Moreover, the latter excludes Navy officers and all Marine Corps personnel (for whom such a geographic distribution is not available).

<sup>10/</sup> An exception lies in the case of patients from the Philippine Islands, of whom there were only 1.8 percent in the 555 heart sample. In contrast, 13.1 percent of the U. S. plus Philippine populations in 1960 resided in the Philippines; these islands became independent in 1946. For comparison with a Navy strength in 1960 which included 2.6 percent of such nationals, these Filipinos have been included with the foregoing U. S. total.

## SECTION III

## FINDINGS

## A. MEDICAL HISTORY PRIOR TO ASHD ONSET

In the review of these patients' histories, references to pertinent factors preceding onset of ASHD were noted. Most of these data showed no significant variations between the living and the deceased groups nor any substantial fraction of the whole patient sample involved. However, some factors discussed in the following pages occurred in a sufficient fraction or showed a significant mortal ratio 11/ to warrant further consideration.

Prior Cardiovascular Patient History. About a quarter of the ASHD patients had a prior history, which retrospectively could be considered as furnishing clues, suggesting possible or probable development of ASHD. In this group, there was no noteworthy difference between the living and the dead proportions. Another 10 to 12 percent had other prior cardiac and vascular references, not directly suggesting ASHD; however, together, these two groups of prior cardiovascular references occurred in almost a third of all the ASHD patients' histories — a sufficient fraction in our opinion to warrant retention of these factors in later analyses. (See Table D, Appendix B).

11/ Mortal ratio is defined as relative proportion of living vs. dead patients, showing a particular characteristic.

These symptoms and signs for both groups were: prior references from civilian and military sources to "angina" or "heart trouble", complaints of chest pain (with or without dyspnea, dizziness, radiating pain, fainting or coma), abnormal ECG's, tachycardia and arrhythmias, the use of digitalis, cardiac enlargement (from x-ray or other examination evidence), retinal signs, and difficulties with the vascular system in the lower extremities.

Family Cardiovascular and Diabetes History. About one-third of the sample, i.e., a proportion similar to that showing prior patients' cardiovascular history showed cardiovascular disease and/or diabetes in the patients' families. Prior diabetes occurred in few ASHD patients themselves because such occurrence usually would have been sufficient reason to separate the member before he acquired ASHD. For these family histories, likewise, there was no substantial difference in the living/dead ratio. The total fraction involved (about 30 percent) was regarded as suggestive as clues to ASHD development. Data for family cardiovascular/diabetes history and for prior patient cardiovascular history are given in Tables E and D, Appendix B.

Poor Condition of Teeth. In the past, the theory of "focus of infection" was much debated, especially in regard to abscesses and other dental infections, raising the question of its possible relation to onset of ASHD. Moreover, poor teeth are now regarded as a clue to poor diet.



Over half of the patients in this sample had teeth in fair or good condition prior to ASHD onset. However, an additional substantial fraction had full or partial dentures -- raising the total of those with poor teeth or replaced teeth to more than 40 percent of the whole group. (See Table F, Appendix B).

Other Minor Ill-Health. Table F in Appendix B also shows the proportions of patients with minor ill-health prior to onset of ASHD. For example, chronic or recurring respiratory infections, tonsillitis and bronchitis; chronic skin and fungus infections; and repeated bouts of gastritis, diarrhea, constipation, or indigestion were included in this category. No major illness, requiring more than a few days hospital care, were so categorized. These latter are to be considered in later analyses.

Few patients had frequent bouts of minor sickness, but if added to these, patients with lesser incidence of minor sickness are included, more than half the ASHD group is involved. This seemed, as with poor teeth, to be a factor requiring further consideration, particularly in comparison with non-ASHD controls.

#### Prior Hypertensive Blood Pressure and Obesity

In the past both hypertension and obesity have been cited as contributing to incidence of ASHD. All hypertension authorities do not agree on a definition of minimum level of hypertensive blood pressure. Therefore, we have made an arbitrary division into normal, borderline and definitely hypertensive levels -- de-

defined in Table 7 on the next page. The data so arranged can be reclassified according to the user's choice. Moreover, many authorities maintain that there is a direct relationship between obesity and blood pressure; theoretically, therefore, one should take into account the relative obesity in judging whether or not a patient's blood pressure is hypertensive. For that reason, a special Table G is provided in Appendix B showing proportions of patients who have definite hypertensive levels as well as being obese -- without an adjustment reflecting this obesity-blood pressure relationship, since at this time we do not know how to make this type of adjustment.

Table 7 shows the data separately for several levels of blood pressure and also for several levels of obesity -- both measurements taken from readings made sometime within the three years preceding ASHD onset and representing the "trend" at that time. The blood pressure levels of two-thirds of the patients were within our "normal" limits (i.e., below 135/85 mm Hg) prior to onset of ASHD. The remaining third showed higher levels (i.e., 135/85 or higher). Since it was suspected that those in a borderline range prior to ASHD onset would show "definite" hypertensive levels later, "borderline" along with "definite" hypertensive levels were included to estimate their hypertensive levels at onset.

TABLE 7: PRIOR HISTORY OF HYPERTENSIVE BLOOD PRESSURE LEVELS AND OBESITY

(i) <u>Blood Pressure Level</u> Prior to ASHD Onset	<u>Living Patients</u>		<u>Deceased Patients</u>	
	Number	Percent	Number	Percent
All ASHD Patients--Total	<u>241</u>	<u>100</u>	<u>260</u>	<u>100</u>
Normal B.P. (under 135/85)	163	68	165	63
Borderline (135/85 — to & incl. 144/94)	41	17	60	23
Definitely hypertensive levels (145/95 or over)	37	15	35	14
(Borderline or higher <u>a/</u> )	<u>(78)</u>	<u>(32)</u>	<u>(95)</u>	<u>(37)</u>
(ii) <u>Relative Obesity Prior</u> to ASHD Onset				
No obesity <u>b/</u>	110	45	104	40
Some obesity	117	49	144	55
Much obesity	14	6	12	5
(Some or much obesity <u>a/</u> )	<u>(131)</u>	<u>(55)</u>	<u>(156)</u>	<u>(60)</u>

a/ This line of data is equal to the sum of the two preceding lines.

b/ The obesity standard used in classifying patients in Part ii of this table is roughly that of the Navy's middle or "standard" level for each height class, but with a rough 10 percent overage allowed before the patient was labeled as having "some obesity". When he obviously was grossly overweight by this same standard, he was labeled with "much obesity".

A somewhat more abnormal pattern than for blood pressure is shown in Table 7 for patients with obesity. More than half of these patients were obese by our study standards; 55-60 percent reflected "some" or "much" obesity (as defined in footnote b to the table above). A more exact estimate of each patient's relative obesity is now being electronically computed—based on his exact weight-to-height ratio on each occasion for which these measurements were obtained

throughout his entire Naval career. This index will be adjusted to provide an allowance for the heaviness of the patient's skeletal frame at age 25, and in addition further comparisons will be made between the unadjusted index and two separate standards — (i) that of the Navy's "standard" weight allowance, and (ii) that of the Metropolitan Life Insurance Company's "desirable" standard.

#### Prior Venereal Disease History

The Venereal Disease infection rate per 100,000 persons is much higher among enlisted men than among officers, as would be expected. In view of this we have limited the following discussion to the enlisted personnel. Prior to the introduction of the common use of penicillin for Venereal Disease treatment in the late 1940's, VD infection references in the enlisted man's medical records are regarded as a rough index of the real VD incidence.

In this ASHD enlisted segment, more than half (56 percent) had no VD entries prior to ASHD onset. A large fraction (44 percent), however, did have such infections — most with infrequent reinfection and prior to World War II, but a few (8 percent) with frequent reinfection over many years span. For these reasons, VD infection among enlisted men prior to ASHD onset has been earmarked for further investigation in relation to development of ASHD.

#### Prior ECG Record

ECGs obtained prior to onset of the first ASHD episode were available for only a third of these confirmed ASHD patients. Most

of the tracings for that third were negative, however (either a routine ECG or a Masters' Test or both). For 8 percent of the living and for 6 percent deceased, ECG tracings were positive. This proportion would ordinarily be considered too small for earmarking in relation to ASHD development. However, in view of the exceptional weight given by cardiologists to positive ECG tracings as an ASHD indicator, this factor has been retained for further analysis. We will attempt to evaluate statistically the importance of all prior abnormal tracings as well as definitely positive ECG reports.

Prior Battle Stress, Smoking and Alcohol Consumption <sup>12/</sup>

References in the Navy's medical record to the incidence of battle stress (as well as of other types of situational stresses) and to alcohol and cigarette consumption are not regarded as reliable for obvious reasons <sup>13/</sup>. Therefore, these factors so far have been excluded from analysis of data for this study. All three are considered to be under-reported — but the stress factor for

<sup>12/</sup> Prior battle stress for this study was defined as experience involving substantial wounds, burns, water exposure, or a POW history.

<sup>13/</sup> Battle stress and other types of stress (financial, emotional, family, etc.) are referred to in the medical records only when they have a direct bearing on medical matters or when they become the subject of behavioral or psychiatric investigation. Use of alcohol and cigarettes generally are recorded verbatim in the record, as stated by the patient, although occasionally there are medical comments when the doctor in attendance did not agree with the patient's statement — such as when he denied drinking but appeared before the doctor "under the influence", or when the patient denied excessive smoking in spite of the doctor's contrary observations.

different reasons than for the other two. Thus, evidence of stress appears in the record only when behavioral problems result, whereas the alcohol-tobacco record is probably biased by what the patient thinks is expected.

However, great interest in these three areas of data has been expressed by nearly all research workers and epidemiologists specializing in ASHD who have been consulted on the conduct of this study. The chief reason for this interest, of course, is the dearth of information on alcohol and stress and the inconclusive data on smoking. There is practically no adequate statistical information involving substantial numbers of cases, regarding the effect of stress or of alcohol consumption on development and incidence of ASHD. Several recent studies have explored the effect of cigarette smoking on persons who had already acquired ASHD. There is also some information available on relationship of incidence of smoking to onset of ASHD.

Although no statistics are presented here on these three areas, consideration is being given to the feasibility of investigating two of them (alcohol and stress), through other channels of information -- particularly, the personnel records and other documents maintained by the Bureau of Naval Personnel.

#### B. Occurrence of Complications With and Following First Episode

Cardiac Status. At the first episode the majority of these ASHD patients (almost two-thirds of the survivors and half of the deceased) were free from cardiac complications, other than the basic ASHD condition. In contrast, the status of many patients had changed sub-



stantially by the time of the last medical contact, which for live patients was usually in 1955 or later.

These cardiac complications included sinus tachycardia, various arrhythmias, cardiac enlargement and congestive failure. Such complications are to be expected in a disease with incurable antecedents. In addition, in contrast to the relatively uncomplicated cardiac status of the majority of these ASHD patients at first episode, at last contact their status usually included nearly all cardiac complications exhibited on the first episode -- as well as other new types of cardiac complications developed later. A logical corollary of this observation is that not only the first infarction, but each subsequent one further compromises the heart's status. For this reason, the existence of prior infarctions has been counted separately in Table 8 below as further complication. Table 8 also shows the development of varied cardiac complications in this study group, the presence of prior infarction being shown separately.

Table 8: CARDIAC STATUS AT FIRST EPISODE COMPARED WITH STATUS AT LAST CONTACT

Presence of Cardiac Complications	Living		Deceased	
	First Episode	Last Contact	First Episode	Last Contact
(In percent of each vertical total)				
ALL ASHD PATIENTS	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
No cardiac complications	64	28	50	27
Only one cardiac complication	<u>26</u>	<u>52</u>	<u>34</u>	<u>40</u>
Prior infarction effects <sup>a/</sup>	--	42	--	20
Other types of complication	26	10	34	20
Two or more complications	<u>10</u>	<u>20</u>	<u>16</u>	<u>33</u>
Prior infarction and one other condition	--	8	--	10
All other multiple complications except with prior infarction	10	12	16	23

<sup>a/</sup> Primarily ECG signs, but may include residual examination signs of coronary insufficiency.

Thus at last contact, only a quarter of the 501 patients both living and dead, had sustained no cardiac complications beyond the effects of the basic ASHD. Among the dead patients, most of these negative instances, no doubt, were among the "sudden deaths" for whom the exact cardiac status obviously could not be determined.

Aside from the effects of prior infarctions, living patients with only one cardiac complication decreased from 26 percent at first episode to 10 percent at last contact. Among the deceased, this proportion fell from 34 percent to 20 percent. In contrast, among the deceased, patients with several complications rose from 16 to 23 percent.

Last Recorded Blood Pressure Compared With That of First Episode. Several research groups investigating ASHD have suggested that there is an association between high blood pressure and incidence and severity of ASHD. Data originally collected for this report do not suggest this; however, they are incomplete regarding blood pressure readings for a significant proportion of deceased patients and even for some living patients, both at first episode and at last contact <sup>14/</sup>. Because of these missing recordings, blood pressure comparisons between first episode and last contact are not valid unless substitute estimates for these missing values are supplied.

Where these values were missing we estimated a blood pressure

<sup>14/</sup> Largely because of sudden deaths among the deceased for whom no physical examination was made just prior to death.

level applicable to the general period of the first episode and/or last contact, using all available blood pressure recordings. These usually were those available for a period just prior to the first episode or just prior to last contact. Occasionally a value was estimated from the trend over a somewhat longer previous period.

Table 9 includes these estimated values and represents, we think, a fair picture of any blood pressure changes occurring for these patients over the course of the disease progression. These pressure changes were slight and in themselves are no real clue to progression of ASHD in these Navy patients. However, it will be noted that about half of this ASHD sample showed borderline or definite hypertensive levels. This factor will, therefore, be retained as a possible ASHD-related contributor. Table H in Appendix B shows the original readings with the instances where recordings were unknown.

Table 9: BLOOD PRESSURE AT FIRST EPISODE COMPARED WITH LAST RECORDING <sup>a/</sup>

Blood Pressure Status	First Episode		Last Recorded	
	No.	Percent	No.	Percent
ALL ASHD PATIENTS-TOTAL	<u>501</u>	<u>100.0</u>	<u>501</u>	<u>100.0</u>
Patient in shock (under 110/60mm)	12	2.4	10	2.0
Low and normal (up to 134/84mm)	239	47.7	235	46.9
Borderline levels (135/85 - 144/94mm)	86	17.2	99	19.8
Definite hypertensive levels (145/95 and up)	164	32.7	157	31.3

<sup>a/</sup> Blood pressure in millimeters of mercury. Includes estimated values for patients with missing blood pressure record at first episode and estimated values for missing records at last medical contact.

Aside from blood pressure changes, there were slight but statistically insignificant changes in the occurrence of extra-cardiac vascular complications between the first episode and last contact. We believe this to be explained by the considerably younger age range of these patients, as compared with patients covered by reports on older civilian population samples. Such reports show more renal, cerebral, retinal and peripheral involvement.

Other Major Abnormal Conditions Associated With ASHD. Almost two-thirds of these patients showed one or two other major associated conditions, complicating the outcome of their disease. Most patients had only one such associated condition but slightly more than a third showed none at all.

Obesity was the leader among these conditions -- occurring in more than half of the patients -- both obesity by itself and in a few patients, in conjunction with a variety of other diseases. These included principally diabetes, ulcer and arthritis. Most of these complicating conditions followed some time after the first episode, but in the case of obesity, this characteristic was present in a large proportion of these patients even at the onset of the disease, as noted previously, and in many, generally increased with age.



C. SURVIVAL-TIME FOR THESE ASHD PATIENTS  
(ELAPSED-TIME SINCE FIRST EPISODE FOR LIVING PATIENTS AND TIME  
FROM FIRST EPISODE TO DEATH FOR THE DECEASED)

First Episode Pattern Type and Survival Time

Living vs Dead Patients. Most of these ASHD patients had first episodes in 1950 or 1951 and thus survivors still alive by January 1963 have lived at least 11 years. About half of the live group, shown in Table I, Appendix B, had a myocardial infarction at the first episode. More than a third, however, on this first episode, had only angina pectoris symptoms or a more prolonged variant such as acute, prolonged coronary insufficiency (see Appendix A, Part 3). The remaining small segment had milder or atypical first episodes.

These figures are in contrast to the much larger proportion (over three-quarters) among the deceased who had first episode infarctions -- and the much smaller proportion with what appeared at first episode to be milder and less damaging manifestations.

Among Deceased Patients. Survival-time logically would appear to be a fairly realistic inverse measure of the real severity of the progression of this disease among patients now dead. In order to demonstrate the relation of the first episode severity type to survival time, all patients were classified in decreasing order of survival time -- in two groups: (a) those with severe first episodes and (b) those with milder first episodes. The corresponding proportions of patients having severe first attacks are compared in Table 10 on the next page with patients having apparently mild episodes. These data show a substantial increase in the proportion with severe first epi-

sodes as the survival time declines, and a complimentary increase in the proportion of mild first episodes as the survival time increases. This finding was expected and agrees with our first major working hypothesis discussed earlier.

Table 10: SURVIVAL TIME BY SEVERITY OF FIRST EPISODE TYPE

Severity Type	Classification by Survival-Time Group			
	Total-All	Still	Deceased Patients	
	First Episodes	Living Patients	Living 6 mos. or more	Living less than 6 mos.
Total Patients: No.	<u>501</u>	<u>241</u>	<u>165</u>	<u>95</u>
Percent	(100)	(100)	(100)	(100)
Patients with severe <u>a/</u> first episodes: No.	329	128	115	86
Percent	(66)	(53)	(70)	(91)
Patients with mild <u>b/</u> first episodes: No.	172	113	50	9
Percent	(34)	(47)	(30)	(9)

a/ Severe first episodes were those with "myocardial infarction" (with or without congestive failure) and cases of "sudden death" and "fatal arrhythmia".

b/ Mild first episodes were those of "angina pectoris", "arterio-sclerotic heart disease" without proven infarction, "acute (prolonged) coronary insufficiency" without infarction, and a few other milder or atypical manifestations.

Number of Episodes vs. Elapsed Time (or Survival Time) Since First Episode <sup>15/</sup>

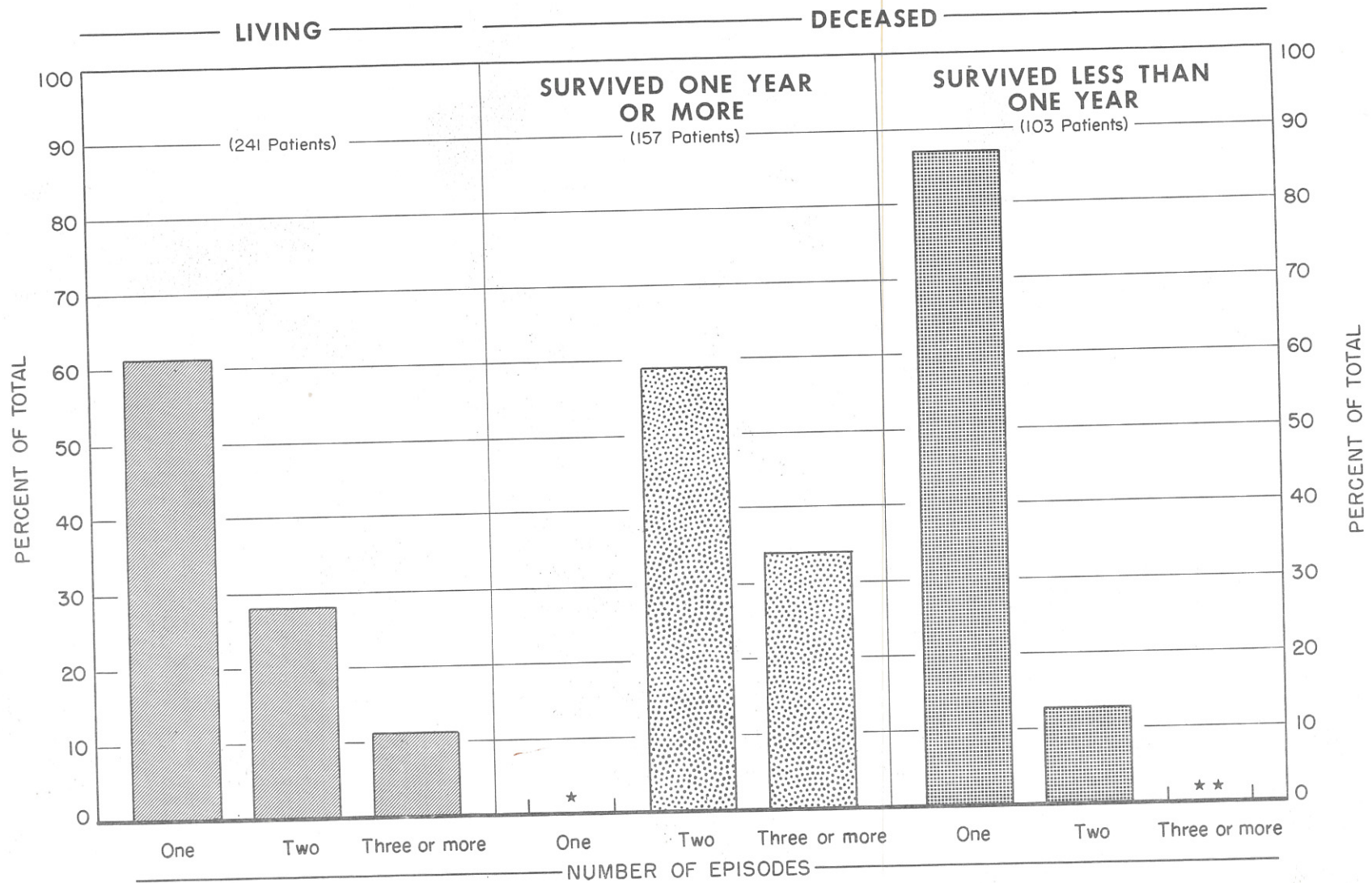
In Living Patients. In general, for each elapsed time group, shown in Table J, (Appendix B), there are smaller numbers of persons associated with each increase in the total number of episodes experienced by a patient. Thus for the 125 live persons with less than

15/ The term "survival time" will be restricted hereafter to deceased patients only.



Figure 2

# **SURVIVAL TIME BY NUMBER OF EPISODES**



\* 7% (12 cases) experienced only one episode but died of other causes.

\*\* No cases in this category.

12.0 elapsed years time since the first episode, 90 had only one episode, 26 had two, and 9 had three or more. A similar reduction in numbers of live patients involved occurred for the 116 persons with elapsed time of 12.0 years or more. (See Fig. 20 on facing page).

This demonstrates, in an indirect fashion, the effect of repeated episodes -- indicating that those live persons with fewer episodes have survived in larger numbers than those with many. The effect is striking -- each additional episode more than halving the number of surviving patients in the next "episode-number" group.

In Deceased Patients. A similar relationship exists for the patients now dead, except that in this case the term "survival time" (a real measure for dead patients) was substituted for the term "elapsed time since first episode". The result of repeated episodes is somewhat similar in effect to that observed among living patients -- a successive decrease in the number of patients in each survival group with each additional episode. This is illustrated by Table J, (Appendix B), and by Table 11 below:

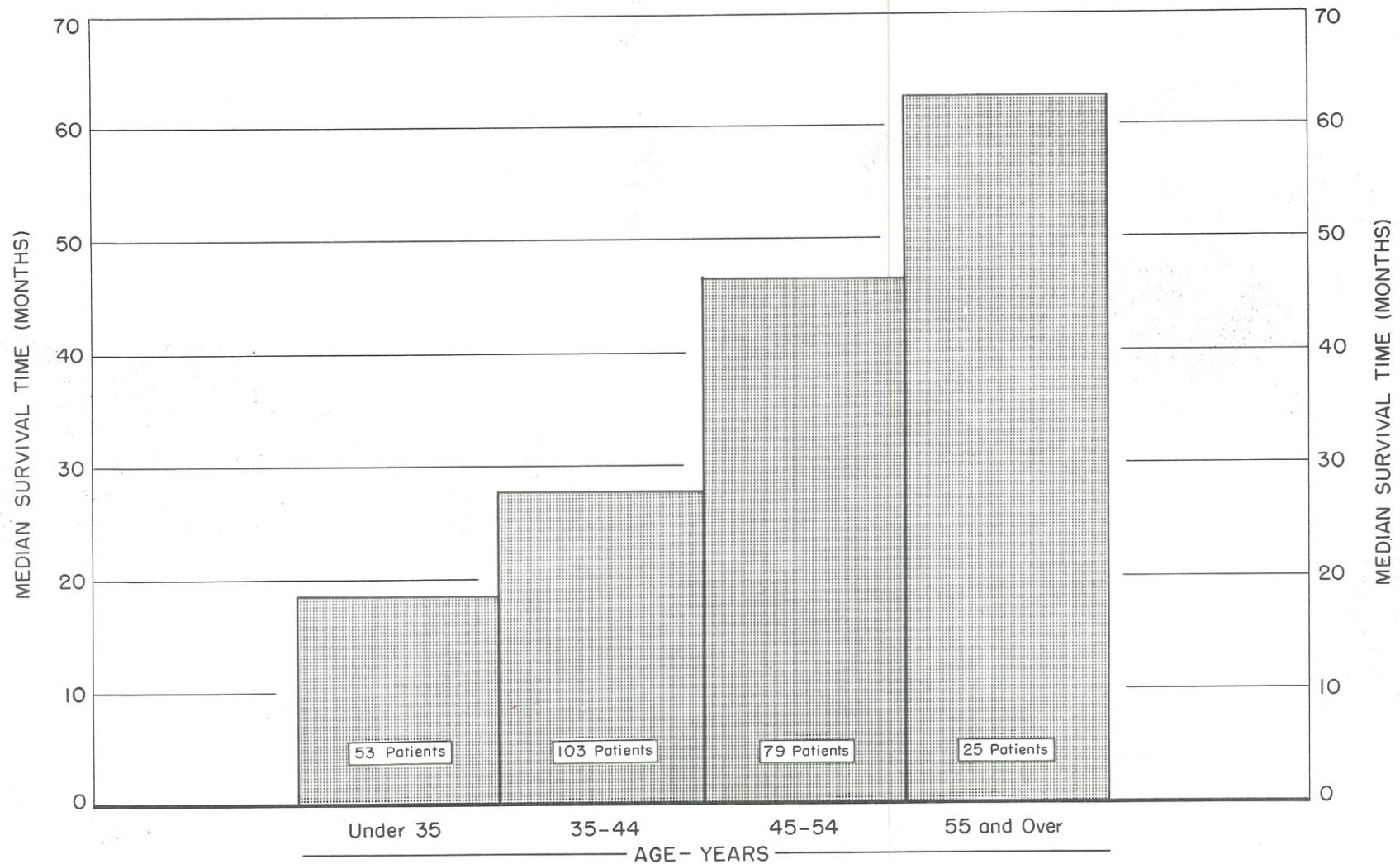
Table 11: SURVIVAL TIME VERSUS NUMBER OF EPISODES

Number of Episodes	All Patients Total	Deceased Patients Surviving Less Than One Year	Deceased Patients Surviving One Year or More	Still Living Patients
Total no.	501	103	157	241
Percent	(100)	(100)	(100)	(100)
Patients with:	(In percent of total of each column)			
Only 1 episode	(49)	(87)	(7) <sup>a/</sup>	(61)
Two episodes	(35)	(13)	(59)	(28)
Three or more	(16)	(--)	(34)	(11)

<sup>a/</sup> Obviously, these 7 percent - representing about a dozen patients - included very few who died of the effects of the first episode. Most of them died of accident or other diseases, including cancer, other cardiovascular conditions, pulmonary complications, etc., two patients of undetermined causes, one suddenly on shipboard.



Figure 3  
**AGE AT ONSET vs SURVIVAL TIME**  
**260 DECEASED ASHD PATIENTS**



### Survival Time Versus Age at Onset

Among deceased ASHD patients, analysis by survival time methods reveals a striking relationship between age at onset and survival time -- older patients tending to survive longer than younger ones. For example, the median survival time for the deceased patients who were under age 45 at the time of onset was 24.6 months, while for those age 45 and over, the corresponding survival time was 50.9 months -- more than twice as long. Division of the deceased patient sample into age groups by ten-year intervals reveals a similar consistent relationship -- median survival time increasing with each successive older age group (see Table K, Appendix B). (See Fig.3 also).

### Survival Time Analysis of Other Factors

The survival time analysis procedure demonstrated in the foregoing discussion appears worth applying to a number of factors which apparently may be related statistically to onset or to progression of ASHD. This procedure is now being applied in a similar manner to factors which revealed some possible relationship in the presentation in Section III, as well as to the following additional factors not explored so far: major diseases contracted prior to first episode; region of birth; patient's symptoms and physical examination signs during the first episode; ECG signs on first episode; and type of additional episodes and their complications. This survival time analysis will be presented in the foregoing terms, as well as in terms of actuarial mortality rates and of survival-time averages for each segment of the sample.

A further source of analytical material lies in comparisons (where possible) between (a) ASHD patients and healthy controls and (b) between ASHD patients and the whole Navy roster. Results of these several types of analysis will be presented in following reports.

An additional area of analysis to be explored in the coming months will be the relation of progression and severity of this disease and the corresponding administrative steps taken in disposition of these cases -- both in terms of character and of timing. Data for such an analysis are now being processed.



List of Appendices to Interim Report on ASHD Study

- Appendix A: Part 1: Arteriosclerotic Heart Disease Defined  
Part 2: Schedule of ASHD Pattern Types  
Part 3: Criteria for Acceptance of ASHD  
Pattern Types (bound with main report)
- Appendix B: Part 1: List of Supplemental Statistical Tables  
Part 2: Supplemental Statistical Tables (with main  
report)
- Appendix C: Statistical Development of Heart Sample Page C 1
- Appendix D: Non-ASHD Patients in the Heart Sample Page D 1
- Appendix E: "Sudden Death" Cases in the ASHD Sample Group  
Page E 1

## APPENDIX A

Part 1: Arteriosclerotic Heart Disease Defined

Arteriosclerotic heart disease (or coronary heart disease) has frequently been alleged to be a disease characteristic of modern society -- most prevalent in the United States and in Scandinavia'-- but frequent in all "civilized" countries to some extent and less so in the less "civilized" nations. It attacks men predominantly in the middle ages on (from 40 years on) and even women but then chiefly after menopause and into the 60's. Formerly it was thought to be solely a disease of old age and no doubt a large fraction of non-accident deaths in older people (above 55 years) do occur as the result of this affliction.

However, in recent years there has been a more general recognition that the disease attacks men under 55 years of age with great frequency. With improvement in diagnosis and with the early detection of the accompanying symptoms, examination signs and characteristic ECG, laboratory, and x-ray evidence of the disease, it has become apparent that it is an important disabler and killer even of young and early-middle-aged men, the latter ages representing the more experienced Naval personnel.

For this reason, this disease was selected by this Bureau for study by statistical research methods. These methods have been applied to the medical records of a representative sample of Navy patients who acquired the disease chiefly toward the end of their active Navy careers but while predominantly still in this middle-age-range.

This disease has been commonly known as "coronary artery disease", but has also been labeled "atherosclerotic heart disease" both in England and in America and more recently "Ischemic Heart Disease" -- chiefly in England and on the continent. All of these terms have certain advantages and are sponsored by eminent cardiologists and epidemiologists. Each term also has certain drawbacks.

In order to conform to the DDDIC\* nomenclature and coding procedure, as well as to the International Classification of Diseases on which the former code is based, this study will continue to use the term "arteriosclerotic heart disease", with occasional references to "coronary heart disease" for variety's sake. This decision is arbitrary and a matter of convenience.

\* Department of Defense Disease and Injury Codes (NavMed P-5082), 1 July 1963.

The disease is manifested in its mild form by chest pain, accompanied frequently by shortness of breath -- relieved by rest and/or nitroglycerine. This is the classic pattern of angina pectoris, thought to be due to an ischemic condition in the heart muscles due to insufficient coronary blood supply to them. More acute manifestations arise when the ischemia continues with no relief from rest or nitrates -- usually resulting from substantial block or occlusion or narrowing of a major coronary artery. The chest pain in these instances is more intense and frequently "radiates" to the arms and shoulders, requiring narcotics for relief. Such pain is accompanied frequently by nausea, vomiting, weakness, pallor, dizziness and other signs of violent reaction by the circulatory system in an effort to adjust to the ischemic condition. Such ischemia generally produces, under these circumstances, serious damage to substantial areas of heart muscle -- resulting in a chain of events characteristic of a "myocardial infarction". These are, in the usual order: an initial "shock" pulse and blood pressure, a rise in white blood cell count, in temperature and in red blood cell sedimentation rate, and later an increase in SGOT\*\*. Frequently the heart system attempts to overcome the ischemia by increase in heart rate, blood pressure and by other means -- evidenced by an adjustment of heart function and musculature (such as by cardiac enlargement and/or hypertrophy).

Further manifestations occur when such adjustment attempt by the heart is unsuccessful (particularly in older patients or in patients whose hearts have substantially lessened reserve -- such as that resulting from several previous infarctions). When this happens, congestive failure sets in. This latter state occurs in younger patients, as well as in older ones, with extremely severe coronary ischemia -- even when no permanent myocardial cell damage has occurred (no evidence of infarction) -- particularly when the patient has some concomitant chest, lung, or related infection, or other unusual systemic burden on the circulatory system.

Finally there are atypical episodes of ASHD which may exhibit borderline manifestation of any of the above or combinations of them, with or without what are usually considered characteristic symptoms, signs, lab test results and ECG evidence of the ischemia due to ASHD.

\*\*Serum glutamic oxalo-acetic transaminase (an enzyme released by certain kinds of dying cell tissue, including that of the heart).



The usual pattern of development is a period of mild angina pectoris symptoms which the patient frequently ignores -- followed by a more serious episode or by an outright infarction. If the latter occurs and if the patient survives it and adjusts his stress-activity-diet pattern\* to his post-infarction coronary capacity he may survive a long time. But adjustment varies with the individual and many coronary patients, therefore, have further episodes of angina-like pain and underlying myocardial insufficiency -- frequently followed by further infarction episode(s).

#### Basis for Terminology and Nomenclature for ASHD

The recently adopted coding system provided by the Department of Defense Disease and Injury Codes (DDIC) in July 1963 adheres primarily to the term "Arteriosclerotic Heart Disease" and minor variants of this term, with "coronary artery disease" used as a supplementary indexing term (and with only one cross-reference, for finding purposes, to "atherosclerotic heart disease".) Moreover, the Index Medicus, published by the National Library of Medicine, does not use the term "atherosclerosis" at all as an indexing modifier for heart disease but only in connection with degenerative processes centered elsewhere in the anatomy (abdomen and lower extremities).

Finally, the majority of American and a large portion of British authorities use "arteriosclerotic" rather than "atherosclerotic" as such a modifier for heart disease -- including the "Standard Nomenclature of Diseases and Operations", (1961) published by the AMA and the International Classification of Diseases (1957) published by the World Health Organization. Both of the latter references have occasional entries of "atherosclerotic", all cross-referenced to "arteriosclerotic". On the continent of Europe "atherosclerosis" is used more frequently as well as in selected papers issued by the World Health Organization -- together with the alternate terminology "Ischaemic Heart Disease", which is in much more frequent use in Europe than in this country or England.

\* These three relationships of behavior to ASHD development are conjectural; we do not know how patients adjust but they appear to vary widely in this ability.

## APPENDIX A

PART 2: SCHEDULE OF ASHD PATTERN TYPES\*

(For selection for statistical classification of patient status at beginning of each major episode).

<u>Code</u>	<u>ASHD Pattern Type</u>
0.	Fatal arrhythmia and selected cases of "sudden death" <u>a/</u> (only those which can fairly definitely be ascribed to ASHD).
1.	Asymptomatic infarction (this diagnosis based on ECG evidence only).
2.	Angina pectoris.
3.	Prolonged (acute) coronary insufficiency <u>b/</u> .
4.	Myocardial infarction (symptomatic).
5.	Infarction (symptomatic) accompanied by congestive heart failure.
6.	Asymptomatic infarction (ECG evidence) at some prior period with subsequent overt episode of angina pectoris (or any other pattern <u>c/</u> ).
7.	Angina pectoris accompanied by congestive heart failure.
8.	Asymptomatic ASHD (or coronary ischemia); ECG evidence only from a Master's Test.
9.	Atypical ASHD; other symptoms of angina pectoris <u>except anginal pain</u> - usually with a positive Master's Test.

a/ Where there is more evidence than just a civil death certificate (signed but with only brief attendance by a physician unfamiliar with the patient).

b/ Few instances of this type occurred; this may have been partly due to the inability of the recording team to recognize the symptoms and signs (as distinct from angina pectoris). For this reason we are presenting these type 3 cases together with type 2.

c/ Statistical treatment of a 2nd episode of other patterns (other than anginal) will depend upon how many turn up.



APPENDIX A

## Part 3: Criteria for Acceptance of ASHD Pattern Types

<u>Code</u>	<u>Pattern Situation</u>	<u>Comments</u>
0	<u>"Sudden Death" and patients dying with fatal arrhythmias</u>	<p>1. Evidence for manifestations of this pattern must come from reported symptoms, observed examination signs, ECG's and/or autopsy reports or reports from physicians in attendance on the patient for some time prior to the death episode and familiar with his heart condition.</p> <p>A death certificate signed only by a coroner or doctor who has not treated the patient for a heart condition will not be considered "evidence". Therefore, all cases such as coroner's certificates are to be excluded as well as other cases on which no objective evidence is available.</p> <p>When only suggestive clues are available (such as abnormal blood pressure records, reports of abnormal heart sounds, prior heart references or familial references to heart disease at ages under 55, such cases will be considered but will be earmarked so that they may be counted separately if necessary.</p> <p>All "excluded" cases will be accounted for and described as part of the original sample of 555 patients, although they may not be included in detailed "ASHD" statistics.</p>
1	<u>Asymptomatic Myocardial Infarction</u> (Based on ECG evidence only)	<p><u>Symptoms:</u> none admitted</p> <p><u>Signs on Examination:</u> none</p> <p><u>ECG:</u> shows pattern of recent or old myocardial infarction; see Code 4 for ECG Q wave findings. If Master's Two-step test is "classically" positive for ASHD, this is additional evidence, but must not be used alone. See Code 2 for classical angina pectoris ECG signs.</p>
2	<u>Angina Pectoris</u>	<p><u>Symptoms:</u> Sudden onset of chest pain (usually precordial) following exertion, eating, emotion or exposure to cold; often accompanied by palpitation, faintness, dizziness, dyspnea, belching, fear of sudden death and sometimes orthopnea or nausea.</p> <p><u>Signs:</u> Pain relieved by rest and/or nitrites (usually sublingual nitroglycerine); signs follow exertion-pain/rest-relief pattern; frequently also with hypertension, cardiac enlargement, or valvular signs. Usually no temperature rise.</p>

<u>Code</u>	<u>Pattern Situation</u>	<u>Comments</u>
		ECG: Usually normal findings except during an actual attack or during an exercise test (such as Master's). Classical angina pectoris ECG findings are obtained only during an actual attack or during a Master's or other exercise test. They are the following: T wave inversion with or without ST depression (or flattening); frequent ventricular extra systoles; right or left bundle branch block; auricular fibrillation; positive Master's test (on "double" if not positive on "single" test).
3	<u>Prolonged Coronary Insufficiency</u> (Acute)	<p><u>Symptoms:</u> Anginal pain of long duration (more than 5 minutes), usually lasting from 5 to 45 minutes and usually less than one hour; usually not classically relieved by nitroglycerine; sometimes other symptoms noted for angina pectoris, such as faintness, dyspnea, etc.</p> <p><u>Signs:</u> Temperature rise is more likely than with angina pectoris, but is less frequent than with myocardial infarction. Response to nitroglycerine and/or rest is much less sharp -- often no response. "The signs are temporary and nonprogressive" <u>1/</u>.</p> <p>ECG: Shows ST segment depression, with or without T wave inversion <u>2/</u>; <u>abnormal Q</u> waves are absent. (AMA: "shows elevated S-T waves") <u>1/</u>.</p>
4	<u>Myocardial Infarction</u> (Symptomatic)	<p><u>Symptoms:</u> Usually a prior anginal attack; may progress through an acute prolonged coronary insufficiency stage; lasting much longer, however (usually 1 to 8 hours) and frequently requiring morphine for relief.</p> <p>Sudden, severe, protracted substernal compression with pain, frequently radiating to arms, neck, abdomen or jaw; and sometimes with dyspnea, weakness, nausea and vomiting.</p>

1/ Current Medical Terminology, American Medical Association 1963 (Chicago, 1962).

2/ These may be transient.



<u>Code</u>	<u>Pattern Situation</u>	<u>Comments</u>
		<p><u>Signs:</u> Slight elevation in temperature (from +0.4°F to +2.0°F); nitroglycerine usually gives no response; morphine usually does. Frequently there is rapid shallow respiration; hypotension and/or shock; weak or thready pulse; arrhythmias; premature contractions; gallop rhythm; ventricular paroxysmal tachycardia; basal pulmonary rales.</p> <p><u>Laboratory:</u> High white cell count, elevated sedimentation rate and high serum enzyme levels (SGOT).</p> <p><u>ECG:</u> The ECG evidence must be explicitly stated by the doctor as a "myocardial infarction" (or some near-variant of this terminology). This evidence is usually obtained from serial examination of ECG tracings, compared over several days series of ECG tests. The ECG signs are: (i) peaking of T wave (from a lead opposite the infarction area); (ii) lowering or inversion of a previously upright T wave; (iii) change in ST segment position (slight, 1 mm. or more, elevation or depression); a depressed ST segment is shown from lead opposite to the infarction area; (iv) appearance of deep, abnormal Q or QS wave <sup>2/</sup>, <u>the most characteristic ECG finding in an infarction.</u></p> <p>When this evidence is not present, other ECG and non-ECG evidence must be used. The Q wave usually endures for a long time (frequently for many years) and is, therefore, the signal also of an old infarction -- as well as of a recent or current one.</p> <p>When the foregoing ECG signs are from lead 1 the infarction is anterior, when from lead 3 and often lead 2, the infarction is posterior (the most common).</p>
5	<u>Myocardial Infarction</u> <u>With Congestive Heart</u> <u>Failure</u>	<p>The symptoms, exam signs, lab data and ECG signs are those of Code 4 (myocardial infarction) plus the following additional for the congestive failure:</p> <p><u>Congestive Failure Criteria</u></p> <p><u>Symptoms:</u> Exertional dyspnea, paroxysmal nocturnal dyspnea, weakness, cough and orthopnea.</p> <p><u>Signs:</u> Enlarged heart; pulmonary "congestion" or "edema" and/or effusion with stress on presence of inspiratory rales; Cheyne-Stokes breathing;</p>

<sup>3/</sup> In the presence of left bundle branch block, the diagnosis must be made on clinical/laboratory grounds without the ECG findings.

<u>Code</u>	<u>Pattern Situation</u>	<u>Comments</u>
	orthopnea, ascites; venous distention, including engorged neck veins; general edema, including evidence of sudden gain in weight or an electrolyte increase; increased venous pressure (above 140 mm. of water); irregular pulse; diastolic gallop rhythm; enlarged liver; weaker heart sounds; slow blood circulation time.	
		<u>Laboratory</u> : Oliguria; albuminuria; urine hyaline casts; increase urine specific gravity.
		<u>X-Ray</u> : Shows pulmonary congestion and/or increased lung field density.
6	<u>Asymptomatic Infarction</u> (ECG Evidence only) on an earlier nonrecorded episode -- followed by a second overt episode of angina pectoris 4/.	This pattern has been selected to provide for a few such cases appearing among Navy ASHD patients. The evidence of the first episode is only from ECG findings (see Code 4 for the description of Q wave abnormality which persists) but may be occasionally verified by the patient or from his medical record in retrospect. Criteria for the second episode of angina pectoris follow those described under Code 2, above 4/.
7	<u>Angina Pectoris with Congestive Failure</u>	This pattern combines criteria for angina pectoris (Code 2, above) plus those for congestive failure described for that condition alone under Code 5, above.
8	<u>Asymptomatic ASHD</u> (or asymptomatic ischemia)	<u>Symptoms, Signs and Laboratory</u> : All negative.
	(Code 2), <u>only</u> during or immediately following a Master's or other exercise test.	<u>ECG Signs</u> : Those of angina pectoris
9	<u>Atypical ASHD</u>	<u>Symptoms</u> : Similar to those of angina pectoris (Code 2) except that no pain is present or the pain is quite atypical (i.e., only in the abdomen or only in the arm(s), neck, or jaw, or combination of these, but not in the chest).
X	<u>Atypical ASHD</u> 5/	Only the mildest symptoms and only slightly abnormal ECG's; diagnosis based on other criteria (prior history, overt signs and lab tests).
4/	There may occur some cases where the second and overt episode is an infarction rather than angina. (Substitute Code 4 signs, in place of Code 2, in this case for the pattern type).	
5/	These manifestations occurred very infrequently and were usually rejected by the medical review panel. There are, theoretically, a number of additional patterns exhibited by this disease. Most of them, we believe, either occur too infrequently to allow dealing with them statistically or they occur in older age groups than included in this Navy study group.	

<u>Code</u>	<u>Pattern Situation</u>	<u>Comments</u>
Y	<u>Atypical ASHD</u> 5/	Only mild clinical and laboratory signs; no ECG evidence; diagnosis on other evidence such as prior history, prior episodes, prior ECG and examination signs.

5/ See note 5 on previous page.



## APPENDIX B

### Supplemental Statistical Tables

#### Part 1: List of Tables

<u>Tables</u>	<u>Title and Contents</u>	<u>Page</u>
A	Official Counts For Original ASHD Heart Sample (1950/51)	B1
B	Age Distribution of All Active Duty Navy and Marine Corps Members; Officers and Enlisted Men: Calendar Years 1950 and 1951	B2
C	Region of Birth of 501 ASHD Patients	B3
D	Patients' Prior Cardiovascular Disease History	B4
E	Patients' Prior Family Cardiovascular Disease History	B5
F	Prior Condition of Teeth and Other Minor Ill-Health	B6
G1	Prior Obesity and High Blood Pressure in 501 ASHD Patients	B7
G2	Prior Obesity and Hypertension Combined, in 501 ASHD Patients	B8
H	Blood Pressure at First Episode Compared With Last Contact (Unknowns Included)	B9
I	Elapsed Time Since First Episode for Living Patients By Severity Type of First Episode	B10
J	Number of ASHD Episodes Among Living Patients by Elapsed Time From First Episode	B11
K	Age at Onset Versus Survival Time for 260 Deceased ASHD Patients	B12

TABLE A: OFFICIAL COUNTS

ASHD Heart Sample  
(1950/51)

	TOTAL	ASHD PATIENTS	NON ASHD
(a) Total	552 <sup>a/</sup>	501	51
Officers	227	210	17
Enlisted	325	291	34
(b) Living (Total)	267	241	26
Officers	118	108	10
Enlisted	149	133	16
(c) Deceased (Total)	285	260	25
Officers	109	102	7
Enlisted	176	158	18

<sup>a/</sup> Excludes 3 regular Navy officers now deceased, for whom the number of episodes and date of onset of the first several episodes are not known -- due to incomplete medical records available for them. They were known to have ASHD, however, but the survival time can not be estimated. The 552 patients totaled above plus these 3 patients account for the 555 patients in the original sample.

TABLE B: AGE DISTRIBUTION OF ACTIVE DUTY  
NAVY AND MARINE CORPS MEMBERS

(Calendar Years 1950-1951 Combined)

AGE GROUP (in years)	TOTAL		OFFICER		ENLISTED	
	Number	Percent	Number	Percent	Number	Percent
Total	<u>1,309,839</u>	<u>100.00</u>	<u>137,736</u>	<u>100.00</u>	<u>1,172,103</u>	<u>100.00</u>
Under 30	1,049,741	80.14	52,831	38.35	996,910	85.06
30-34	142,763	10.90	35,586	25.84	107,177	9.14
35-39	67,610	5.16	23,887	17.34	43,723	3.73
40-44	31,476	2.40	14,366	10.43	17,110	1.46
45-49	12,270	0.94	6,952	5.05	5,318	0.45
50-54	4,461	0.34	2,956	2.15	1,505	0.13
55 and over	1,518	0.12	1,158	0.84	360	0.03



TABLE C: REGION OF BIRTH OF 501 ASHD PATIENTS  
 (Compared with Region of Birth of Active Duty Navy Enlisted Men <sup>a/</sup>  
 and Region of Residence of U.S. Population as of 1960 Census)

Region	ASHD Patients		Enlisted Men Active Duty Navy		U.S. Population 1960 Census	
	Number	Percent	Number	Percent	Number (In Thousands)	Percent
TOTAL	<u>501</u>	<u>100.00</u>	<u>581,577</u>	<u>100.00</u>	<u>183,281</u>	<u>100.00</u>
New England	43	8.58	36,604	6.29	10,509	5.73
Middle Atlantic	93	18.56	99,029	17.03	34,168	18.64
South Atlantic	72	14.37	70,745	12.16	25,972	14.17
E.N. Central	83	16.57	106,708	18.35	36,225	19.76
W.N. Central	73	14.57	66,901	11.50	15,394	8.40
E.S. Central	40	7.98	38,014	6.54	12,050	6.58
W.S. Central	37	7.39	59,594	10.24	16,951	9.25
Mountain	13	2.59	25,252	4.35	6,855	3.74
Pacific <sup>b/</sup>	27	5.39	57,661	9.91	21,198	11.57
U.S. Territories, Possessions, etc.	1	0.20	1,385	0.24	2,585	1.41
All Other Countries	10	2.00	5,625	0.97	1,372	0.75 <sup>c/</sup>
Philippines	9	1.80	14,059	2.42	(27,088) <sup>d/</sup>	

<sup>a/</sup> Source: BuPers Special Tabulation 28 Feb. 1964, as of 31 Dec. 1963.

<sup>b/</sup> Includes Hawaii and Alaska.

<sup>c/</sup> U. S. citizens enumerated as "living abroad" in 1960 census.

<sup>d/</sup> The Philippine total population figures were excluded from the percentage distribution for region of residence, as no criteria exists for determining what proportion of this rather large population actually represents the base figure from which the Navy (and Navy ASHD) population is drawn.

TABLE D: PATIENTS' PRIOR CARDIOVASCULAR DISEASE HISTORY

	Total Number	Living		Deceased	
		Number	Percent	Number	Percent
Confirmed ASHD Patients	<u>501</u>	<u>241</u>	<u>100</u>	<u>260</u>	<u>100</u>
No Prior Patient CV History	355	162	67	193	74
Prior CV History	146	79	33	67	26

TABLE E: PATIENTS' PRIOR FAMILY CARDIOVASCULAR DISEASE HISTORY

	Total Number	Living		Deceased	
		Number	Percent	Number	Percent
Confirmed ASHD Patients	<u>501</u>	<u>241</u>	<u>100.0</u>	<u>260</u>	<u>100.0</u>
No Prior Family CV or Diabetic History	355	163	67.0	192	74.0
Prior Family History	146	78	33.0	68	26.0

6 2 0 5

TABLE F: PRIOR CONDITION OF TEETH AND OTHER MINOR ILL-HEALTH

Prior Condition	Total Number	<u>Living Patients</u>		<u>Deceased Patients</u>	
		Number	Percent	Number	Percent
TOTAL ASHD CASES <sup>a/</sup>	<u>504</u>	<u>241</u>	<u>100.0</u>	<u>263</u>	<u>100.0</u>
Fair or good tooth condition	287	140	58.1	147	55.9
Poor teeth or with dentures	217	101	41.9	116	44.1
-----					
Little minor ill- health	240	111	46.0	129	49.0
Some degree of minor ill-health	264	130	54.0	134	51.0

<sup>a/</sup> Includes 3 deceased officers who have been excluded from some tables for which information was lacking in their medical records.

TABLE G(1): PRIOR OBESITY AND HIGH BLOOD PRESSURE IN 501 ASHD PATIENTS

Blood Pressure and Obesity Level	Living		Deceased	
	Number	Percent	Number	Percent
Confirmed ASHD Cases-Total	<u>241</u>	<u>100.00</u>	<u>260</u>	<u>100.0</u>
(i) PRIOR HYPERTENSIVE BLOOD PRESSURE				
(a) Normal (Below 135/85 m.m.)	163	67.6	165	63.4
(b) Borderline (135/85-144/94 m.m.)	41	17.0	60	23.1
(c) Hypertensive(145/95 and over)	37	15.4	35	13.5
(d) Borderline or Higher <u>a/</u>	(78)	(32.4)	(95)	(36.6)
(ii) PRIOR OBESITY				
(a) No Obesity	110	45.6	104	40.0
(b) Some Obesity	117	48.6	144	55.4
(c) Much Obesity	14	5.8	12	4.6
(d) Obesity (Some or Much) <u>a/</u>	(131)	(54.4)	(156)	(60.0)

a/ Line (d) in each section is the sum of lines (b) and (c).

General Note: As indicated in the Interim Report on page 18, some authorities maintain there is a direct relation between obesity and hypertensive blood pressure phenomena. The table above shows what proportions of ASHD patients have either borderline and higher blood pressure or Borderline and higher obesity.

In Table G2 on the next page, these combinations are defined somewhat differently, but in neither table is there any attempt made at adjustment to allow for the foregoing alleged pressure/weight relationship. Tables G1 and G2 illustrate that there is a very large segment of this ASHD patient group which is in a questionable blood pressure group or questionable weight group, or both.



TABLE G(2): PRIOR OBESITY AND HYPERTENSION COMBINED IN 501 ASHD PATIENTS

Grade <u>a/</u>	Total		Living		Deceased	
	Number	Percent	Number	Percent	Number	Percent
Total	<u>501</u>	<u>100.0</u>	<u>241</u>	<u>100.0</u>	<u>260</u>	<u>100.0</u>
Grade 0	166	33.1	90	37.3	76	29.2
Grade 1	273	54.5	117	48.6	156	60.0
Grade 2	62	12.4	34	14.1	28	10.8
-----						
Grades 1 and 2	335	66.9	151	62.7	184	70.8

a/ See "General Note" to Table G(1). For the purposes of this table, the ASHD patients were divided into three grades on a combined blood pressure/obesity scale. The groupings are defined as follows:

Grade 0: Those patients with both normal blood pressure and normal weight.

Grade 1: "Borderline" patients -- for example, patients with definite hypertension, but no obesity, patients with borderline blood pressures and some obesity, and patients with normal blood pressures but marked obesity.

Grade 2: Patients with significant combined abnormalities -- both in blood pressure and in weight. For example, definitely hypertensive patients with much obesity, definitely hypertensive patients with some obesity, and patients with borderline blood pressures but also much obesity.

TABLE H: BLOOD PRESSURE AT FIRST EPISODE COMPARED WITH LAST CONTACT (UNKNOWNNS INCLUDED) <sup>a/</sup>

BLOOD PRESSURE STATUS	FIRST EPISODE				LAST CONTACT			
	Living		Deceased		Living		Deceased	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All ASHD Patients-Total	<u>241</u>	<u>100.0</u>	<u>260</u>	<u>100.0</u>	<u>241</u>	<u>100.0</u>	<u>260</u>	<u>100.0</u>
Patient in Shock (under 110/60 m.m.)	3	1.2	9	3.5	-	-	6	2.3
Low and Normal (up to 134/84 m.m.)	107	44.4	94	36.2	103	42.7	95	36.5
Borderline Levels (135/85-144/94 m.m.)	40	16.6	34	13.1	45	18.8	26	10.0
Definite hypertension (145/95 and up) .	74	30.7	85	32.7	72	29.8	63	24.3
Unknown Blood Pressure <sup>a/</sup>	17	7.1	38	14.5	21	8.7	70	26.9

<sup>a/</sup> For these patients, no entry was available in the medical record which was directly applicable to the blood pressure status at these two occasions. Most of them were patients who died suddenly or within a very short time from onset of this episode.

TABLE I: ELAPSED TIME SINCE FIRST EPISODE FOR LIVING PATIENTS (BY SEVERITY TYPE OF FIRST EPISODE)

ASHD Pattern (Severity) Type	All Live Patients	Elapsed-Time Group		
		Less than 12.0 years	12.0 to 12.9 years	13.0 years or more
Total: Number	<u>241</u>	<u>125</u>	<u>68</u>	<u>48</u>
Percent	( <u>100</u> )	( <u>100</u> )	( <u>100</u> )	( <u>100</u> )
Severe Types:	(In percent of each vertical column total)			
Myocardial infarc- tion, with and with- out congestive failure	53	52	51	58
Mild Types-Total	<u>47</u>	<u>48</u>	<u>49</u>	<u>42</u>
Angina pectoris	38	39	41	30
Acute, prolonged coronary insuf- ficiency <u>a/</u>	3	2	5	4
All other types <u>b/</u>	6	7	3	8

a/ This type resembles angina pectoris in some respects and myocardial infarction in others, but occurs without evidence of proven myocardial damage and nearly always responds relatively quickly to acute heart disease care in the hospital.

b/ These include 2 patients with asymptomatic infarction ("silent infarct") with only ECG evidence; and 5 patients with asymptomatic ASHD (without infarction), evidenced only by Master's Test.



TABLE J: NUMBER OF ASHD EPISODES AMONG LIVING PATIENTS BY ELAPSED TIME FROM FIRST EPISODE

Number of Episodes	All Live Patients	Elapsed Time Group	
		Less than 12 yrs	12 yrs or more
Total: Number	<u>241</u>	<u>125</u>	<u>116</u>
Percent	(100)	(100)	(100)
Patients with:			
One episode: no.	147	90	57
Percent	(61)	(72)	(49)
Two episodes: no.	67	26	41
Percent	(28)	(21)	(35)
Three or more episodes: no.	27	9	18
Percent	(11)	(7)	(16)

Table K: Age at Onset Versus Survival Time for 260 Deceased ASHD Patients

Age Group (years)	Patients		Median Survival Time (months)
	Number	Percent	
Total	<u>260</u>	<u>100.0</u>	<u>35.1</u>
Under 35	53	20.4	18.5
35 - 44	103	39.6	27.8
45 - 54	79	30.4	46.5
55 and over	25	9.6	64.7

